

LEVINE, BLASZAK, BLOCK & BOOTHBY

1300 CONNECTICUT AVENUE, NW
SUITE 500
WASHINGTON, D.C. 20036-1703
(202) 223-4980
FAX (202) 223-0833

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March 24, 1997

Mr. William F. Caton
Acting Secretary
Federal Communications Commission
1919 M Street, NW
Washington, DC 20554

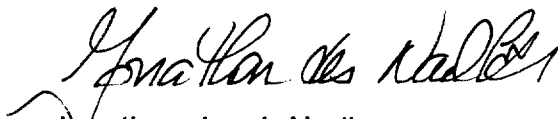
Re: CC Docket No. 96-263

Dear Mr. Caton:

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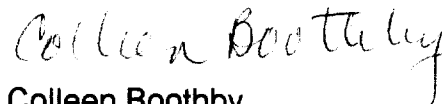
If you have any questions regarding this filing, please do not hesitate to call.

Sincerely,



Jonathan Jacob Nadler
Squire, Sanders & Dempsey, L.L.P.
1201 Pennsylvania Avenue, NW
Box 407
Washington, DC 20044
202/626-6838

Co-Counsel



Colleen Boothby
Levine, Blaszak, Block & Boothby
1300 Connecticut Avenue, NW
Suite 500
Washington, DC 20036-1703
202/223-4980

Co-Counsel

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Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

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Usage of the Public Switched
Network by Information Service
and Internet Access Providers

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CC Docket No. 96-263

COMMENTS OF THE INTERNET ACCESS COALITION

Jonathan Jacob Nadler
Squire, Sanders & Dempsey L.L.P.
1201 Pennsylvania Avenue, NW
Box 407
Washington, DC 20044
202/626-6838

Co-Counsel

Engineering Consultant:

John G. Williams, Ph.D.
Vice President
Telecommunications Consulting Group, Inc.
1201 Pennsylvania Avenue, NW
Suite 400
Washington, DC 20044
202/626-6293

March 24, 1997

Colleen Boothby
Levine, Blaszak, Block & Boothby
1300 Connecticut Avenue, NW
Suite 500
Washington, DC 20036-1703
202/223-4980

Co-Counsel

SUMMARY

Consumers are purchasing personal computers and subscribing to on-line services in unprecedented numbers. Most are doing so for one reason: to access the vast resources of the Internet and other data services. Consumers, however, have little choice but to use the circuit-switched telephone network controlled by their incumbent local exchange carrier ("ILEC") to connect to the Internet and other on-line services. Because the ILECs' networks were designed to carry voice traffic, they provide frustratingly slow connections to the World Wide Web, and are entirely inadequate for emerging multimedia applications.

The Internet Access Coalition (the "Coalition") believes that consumers must have access to high-bandwidth, "data friendly" communications services that will, for example, make retrieving information from a World Wide Web site at least as fast, easy, and affordable as making a local telephone call. The best means by which the Commission could achieve this goal is by modifying its rules to facilitate the entry of competitive providers into the data service market. Consumers will only be able to realize the full benefits of the Information Age when the market for data services is as competitive as the markets for personal computers and information services.

The Coalition anticipates that the incumbent local exchange carriers will need to play a significant role in providing data communications services. For the short-term, the ILECs can efficiently accommodate increased data traffic through minor modifications to their existing facilities – such as distributing data traffic efficiently among multiple end-office switches, and charging cost-based prices that will enable

Internet and other enhanced service providers ("ESP/ISPs") to obtain high-capacity, trunk-side connections that can accommodate their traffic more efficiently.

Looking ahead, the ILECs can significantly increase the efficiency of their networks by using currently available technology to migrate data traffic from the circuit-switched network to packet networks. Packet networks speed data transmissions (and reduce carriers' costs) by allowing data from multiple customers to be transported over a shared transmission facility. While the increased use of packet technology will be beneficial, the ILECs ultimately must deploy the end-to-end broadband capacity necessary to provide users with instantaneous access to the Internet and other information services.

As their long delays in deploying ISDN demonstrate, however, the ILECs are slow to invest in *any* technology other than analog circuit-switched facilities designed for voice traffic. Indeed, even the significant pricing flexibility that the Commission has provided in its Price Caps rules has not induced the ILECs to provide innovative new data transport services. To the contrary, the ILECs have responded to the growth of data traffic by asking the Commission to impose carrier access charges on ESP/ISPs, which would artificially reduce demand for information services. In light of these experiences, it is clear that the *only* way the Commission can ensure that consumers have access to the broadband technologies required for high-speed access to the Internet and other on-line services is to adopt policies that will foster the competitive provision of data communications services.

Competing data service providers -- whether Competitive Local Exchange Carriers ("CLECs"), Competitive Access Providers, ESP/ISPs, or facility-based competitors of the ILECs data communications services -- could use a variety of technologies to offer services. For example, they could provide broadband access to the Internet using the ILECs' existing loop facilities by collocating digital subscriber loop ("xDSL") equipment between the ILECs' central offices and the customers' premises. These providers also could deploy technology that would allow them to share a single local loop with an ILEC -- with the ILEC using the loop for voice telephony, while the data service provider offers simultaneous access to one or more on-line networks. Competition also could allow multiple providers to deploy high-speed packet networks between the ILECs' central offices and the premises of multiple ESP/ISPs.

Although they are not yet significant competitive alternatives, cable, terrestrial wireless, and satellite-based providers ultimately may be able to offer additional means for users to access data services. While the Commission should adopt policies to foster deployment of these alternative infrastructures, the focus of this proceeding should be on the means to facilitate competitive deployment of services that will allow for rapid, affordable, and efficient transport of data traffic over the wireline network.

In order to facilitate entry by competitive data service providers, the Commission must revise its rules. The Internet Access Coalition therefore proposes a five-point program of regulatory reform. Specifically, the Commission should:

- **Unbundle the Part 69 Access Elements.** The Commission should require the ILECs to unbundle the existing Part 69 access elements -- e.g., local loop, switching and local transport -- from each other, so that competitive data service providers can purchase only those ILEC network services that they require to develop competitive offerings.
- **Disaggregate the Loop Access Element into Sub-elements.** In order to enable competitive data service providers to deploy xDSL or similar technology necessary to provide users with broadband capacity over existing facilities, the Commission must require the ILECs to unbundle the local loop access element into its essential sub-elements -- feeder plant, distribution plant, and the feeder/distribution interface -- and make each element separately available.
- **Require Equal Access and Interconnection for Competitive Data Service Providers.** Deployment of competing services that can route data from customers' premises to ESP/ISPs' premises will only be possible if the Commission's rules require incumbent carriers to grant competitive data service providers equal opportunity to interconnect to the incumbent's network and "equal access" to users' data traffic.
- **Allow Collocation of All Forms of Transmission, Switching and Enhanced Service Equipment.** In order to provide competitive data services, data service providers will need to be able to collocate equipment within the ILECs' networks. Therefore, to the extent technically feasible, the Commission should require ILECs to allow collocation (at least on a "virtual" basis) of all forms of transmission, switching, and enhanced service equipment.
- **Require Cost-based Pricing for Access Elements and Collocation.** As the Commission has recognized, competition can only take root if the ILECs make the building blocks of their network available to competitors at prices that replicate those that would exist in a competitive market. The Commission, therefore, should require ILECs to price unbundled access elements and collocation services based on the long-term incremental cost of these offerings.

While the Commission must adapt its rules governing the local exchange network to facilitate competition, it should not alter the deregulatory policies that it has long applied to the highly competitive enhanced service market. In particular, the Commission should not create "sub-categories" of enhanced services, some of which could be subjected to carrier access charges or other forms of common carrier regulation. As the experience in the enhanced service market has demonstrated, competition -- rather than regulation -- is the best means to ensure that consumers realize the benefits of the Information Age.

Based on the record compiled in this proceeding, the Coalition urges the Commission to adopt a Notice of Proposed Rulemaking, in which it proposes specific pro-competitive changes to its rules that will facilitate the deployment of the high bandwidth data networks of the future.

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Attachment A
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Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, DC 20554

In the Matter of)	
)	
Usage of the Public Switched)	CC Docket No. 96-263
Network by Information Service)	
and Internet Access Providers)	

COMMENTS OF THE INTERNET ACCESS COALITION

I. INTRODUCTION

The Internet Access Coalition is dedicated to maintaining affordable consumer access to the Internet and other enhanced services via analog, circuit-switched telephone lines, and to accelerating the availability of affordable, digital, packet-switched consumer connections to these services. The Coalition's member companies¹ and associations² represent all segments -- hardware, software, and services -- of the information technology ("IT") industry.

In this proceeding, the Commission has raised issues that affect not only the telecommunications industry but the nation's economy as a whole. The

¹ Internet Access Coalition member companies include America Online Incorporated, Apple Computer, Inc., Compaq Computer Corporation, CompuServe Incorporated, Dell Computer Corporation, Digital Equipment Corporation, EarthLink Network, Inc., Eastman Kodak Company, GE Information Services, IBM Corporation, Intel Corporation, Microsoft Corporation, Netscape Communications Corporation, Novell, Inc., Oracle Corporation, and Sun Microsystems, Inc.

² Internet Access Coalition member associations include the American Electronics Association, the Business Software Alliance, the Consumer Electronics Manufacturers Association, the Information Technology Association of America, the Information Technology Industry Council, the Internet Service Providers and Users Association, the Software Publishers Association, and the Voice on the Net Coalition.

country's widely-heralded shift to an information intensive economy -- and the benefits of a rapid transition to maintain global competitiveness -- require the unfettered development of innovative and affordable IT products and services and the competitive deployment of those products and services in response to marketplace demand. An up-to-date, affordable national information infrastructure with modern data communications capabilities is a crucial prerequisite for this process.

Only the pressures of a competitive marketplace can produce the affordable and innovative network services and products that consumers need to fully realize the benefits of modern IT products. Congress recognized this when it passed the 1996 Telecommunications Act,³ the purpose of which was, *inter alia*, to accelerate the deployment of information technologies by opening up telecommunications markets to competition. As the Commission has long recognized, competition is the most effective mechanism for reducing the cost of telecommunications services and equipment, spurring innovation, increasing consumer choice, and responding most efficiently to consumer demand.⁴

Due to the lack of competition in today's local exchange markets, businesses and consumers can not obtain the network services they need to optimize their use of IT products and services. The non-competitive local exchange marketplace has failed to satisfy burgeoning customer demand for

³ *Communications Act of 1934 as amended by The Telecommunications Act of 1996*, 47 U.S.C. §§ 151, *et seq.* ("1996 Act").

⁴ See notes 84 to 95 *infra*, and text accompanying.

higher bandwidths, affordable data-friendly services for residential as well as business locations, and diversity in available products and services. Indeed, the only affordable in-home connections available to virtually all American PC users are through analog, circuit-switched telephone lines. As a result, consumer Internet access is limited to a maximum bit rate of about 56 kilobits per second ("kbps") and most users still access the Internet at much lower rates. The information economy cannot flourish at these low connection speeds.

Many of the technologies that would respond to consumer demand for data-friendly network services have already been developed but not routinely deployed by network service providers. A robustly competitive network services marketplace would have spurred service providers to deploy these technologies in response to consumer demand. Instead, incumbent local exchange service providers have delayed or failed to provide these services.⁵ Thus, it is largely marketplace defects, rather than technological limitations, that are preventing customers from using the full panoply of IT products and services currently available.

Therefore, the Commission should adopt the unbundling, collocation, and incremental pricing policies discussed in the paragraphs which follow. These policies would facilitate the development of competition in the provision of data communication services. The Commission's regulatory regime should eliminate bottlenecks in local networks and facilitate entry by potential competitors who

⁵ The 20-year delay in the widespread introduction of affordable ISDN services to local exchange markets epitomizes this problem. See pages 10 to 14, *infra*.

would provide the services needed by IT customers, thereby spurring incumbent providers to do the same. In addition, the Commission's rules and policies should, as a competitive market would, encourage service providers to take business risks and make capital investments in data communications technologies that respond to consumer demand without pre-payment by potential customers and without a guaranteed return. Finally, the Commission's rules should result in network services that are technology-neutral in order to maximize entry opportunities for potential competitors. The Commission should eliminate carrier bundling practices for network services that have resulted in technologically inappropriate components which deter competitive entry and the spread of advanced information services.

II. CONSUMERS MUST USE THE VOICE-ORIENTED PUBLIC SWITCHED NETWORK TO ACCESS THE INTERNET AND OTHER ENHANCED SERVICES.

The public switched telephone network ("PSTN") was designed for circuit-switched voice telephony. Because there are no competitive alternatives, computer users that want to access the Internet and other enhanced services must use the PSTN to send and receive data. This arrangement has worked quite well for the incumbent local exchange carriers ("ILECs"): the growth of data services has generated substantial revenue, which greatly exceeds the resulting costs. Users, however, have been deprived of access to the high-bandwidth, data-friendly technologies necessary for instantaneous access to the vast quantity of available on-line information resources. This section describes the ways in which

Internet and other enhanced service customers use the network, and the substantial benefits that the ILECs have derived from the growth of data traffic.

A. The PSTN Was Not Designed for Data Traffic

A customer typically initiates an Internet or enhanced service session using a premises-based personal computer, which sends a stream of data over the PSTN towards the customer's Internet or other enhanced service provider ("ESP/ISP"). In order for this to occur, the customer's data must first be "translated" from digital format, which is the language of computers, to analog format, which is the traditional language of the telephone network. This function is performed by a modem located on the customer's premises.

As explained in the analysis prepared for the Coalition by Economics and Technology, Inc. ("ETI"),⁶ and illustrated in Figure 1,⁷ the customer's data travels to the end-office of the ILEC that serves the customer's geographic area over the same copper loop plant that the customer uses to make switched voice calls. As a result, most users are only able to transmit and receive data at very slow speeds. Indeed, using the fastest widely available analog modem, a customer can send and receive data at the rate of only 33,600 bits per second (33.6 kbps). This rate

⁶ Economics and Technology, Inc., "The Effect of Internet Use on the Nation's Telephone Network," at 4 (Jan. 22, 1997) ("ETI Study"). The ETI Study was filed with the Commission in *Access Charge Reform, Price Cap Performance Review for Local Exchange Carriers, Transport Rate Structure and Pricing, and Usage of the Public Switched Network by Information Service and Internet Access Providers*, CC Dkt. Nos. 96-262, 94-1, 91-213, 96-263, *Notice of Proposed Rulemaking, Third Report and Order, and Notice of Inquiry*, FCC No. 96-488 (Dec. 24, 1996) ("Access Reform NPRM" or "Information Service NOI") and is included herewith as Attachment C.

⁷ Figures cited in text appear in Attachment A.

is far too slow for multimedia applications. At that rate, for example, it would take a full *16 days* to download a three hour motion picture.

Consumers seeking higher data rates can use Integrated Services Digital Network ("ISDN") service, which allows for data rates of up to 128 kbps over existing local loop facilities. They also can use dedicated, high-capacity circuits, such as T-1 lines, which allow for data to be transmitted at the rate of 1,544,000 bits per second (1.544 Mbps). Because of the high price of T-1 lines, and the difficulty of obtaining affordable ISDN services, however, few ESP/ISP customers actually obtain these services.

Typically, the ESP/ISP's premises will be in the same local calling area as the customer, although the two parties often are served by different ILEC end-offices. In such cases, the switch in the originating customer's end-office routes the customer's data to the switch at the end-office serving the customer's ESP/ISP.⁸ At the end-office serving the ESP/ISP, the customer's data communication is switched to the ESP's access line. The point at which this connection is made depends on the type of access arrangement that the ESP/ISP has obtained.⁹

⁸ If there is a sufficiently high volume of traffic between the two end-offices, the data will be routed over an interoffice trunk that directly links the offices. If there is not sufficient total traffic to justify the installation of a direct link between the end-offices, the customer's call will be routed via a tandem switch. See ETI Study at 8.

⁹ Many ESPs obtain voice-grade business lines, which connect at the line side of the switch. In these cases, data communications from the ESP/ISP's customers have to "compete" with voice traffic for a path through the switch before being connected to the ESP/ISP's access line. Other ESP/ISPs, however, obtain connections on the trunk side of the terminating switch, which enables traffic to be connected to their access lines without having to pass through the terminating switch.

Once the data arrives at an ESP/ISP's premises, it must be converted back to digital format, using one of the modems in the "pool" located at the ESP/ISP's premises. The data are then encapsulated into "packets." Each packet has a header that identifies its destination. From there, the data packets are routed onto the ESP/ISP's private line network or onto the Internet. These networks consists largely of high-capacity circuits, which allow for the rapid and efficient transport of packetized data.

Packets are reassembled at their point of destination and passed to a server.¹⁰ From the server, information is routed back to the ESP/ISP's premises. At that point, the data must again be converted from digital format back to analog to allow it to be sent -- at slow speeds -- over the public switched network to the original customer.

B. The ILECs Have Derived Significant Benefits From the Growth of Data Traffic

Increased data traffic has generated substantial new revenues for the ILECs. The business lines that many ESP/ISPs use to access the network are priced at compensatory rates.¹¹ In addition, ILECs derive substantial income from those ESP/ISPs that use high-priced T-1 lines. A significant number of ESP/ISPs

¹⁰ A server is a computer that stores large amounts of data (such as a World Wide Web page) that is available for user retrieval. During the course of a single on-line session, a subscriber may obtain data from servers in multiple locations within the ESP's network or the Internet. For example, on the Internet, hypertext navigation is used to provide users with links to related information contained in other servers. By clicking on a hypertext link, a user can jump from one server to another server in a different location.

¹¹ *ETI Study* at 24, 25.

also subscribe to vertical services for which the BOCs charge a premium.¹²

Furthermore, most business (and some residential) users pay usage-sensitive charges for local calls.¹³ As a result, use of the Internet and other on-line services by these users generates additional revenues for the ILECs.

The growth of the Internet and other on-line services also has stimulated demand for additional residential and business access lines. According to ETI, in 1995, approximately six million residential second lines were used primarily for on-line access. The revenue generated by these lines exceeded \$1.4 billion. This, by itself, exceeded the BOCs' estimates of the costs imposed on the PSTN by the growth of the Internet and on-line services by a factor of six-to-one.¹⁴

Individuals and businesses use the PSTN to access on-line services at levels that are comparable to many voice customers. As the ETI study demonstrated, on average, ESP/ISP customers use the PSTN for on-line access for only ten to fifteen hours per month.¹⁵ The majority of these customers use the PSTN to remain on-line for less than ten hours per month.¹⁶

Much of the use of the PSTN by ESP/ISP customers occurs during off-peak hours. As explained by ETI, "the cost of operating the PSTN and many of its

¹² See *id.* at 25.

¹³ See *id.* at 24, 25.

¹⁴ See *id.*

¹⁵ See *id.* at 29 n.57.

¹⁶ See *id.* at 26.

components is sensitive to the *peak demand* placed on each network resource."¹⁷

For this reason, off-peak use of the network "does not materially impact network capacity or operating costs."¹⁸ To the contrary, off-peak use increases the total number of minutes of traffic that transits an ILEC switch and thereby lowers the average per-minute cost of using the switch.¹⁹ Thus, rather than imposing additional costs on the network, increased data traffic actually has contributed to the more effective and efficient use of existing network capacity.

III. AVAILABLE TECHNOLOGIES WILL ALLOW INCUMBENT LECs TO TRANSPORT DATA MORE EFFICIENTLY

If consumers are to reap the full benefits of IT appliances and services, the PSTN must become more "data-friendly." Specifically, the network must become capable of routing data traffic more efficiently and at higher speeds. In this section, the Coalition first demonstrates that, in the short-term, the ILECs can readily accommodate the growth of data traffic through modest changes to the existing, voice-oriented, circuit-switched network. The Coalition next shows that technology exists that will allow the ILECs to migrate data traffic to packet networks, which are more suitable for data transmission. Finally, the Coalition explains that the technology that will allow end-users to optimize their use of IT appliances and obtain high-speed, affordable access to the Internet and other enhanced services could be easily and affordably deployed.

¹⁷ *Id.* at 11 (emphasis in original).

¹⁸ *Id.*

A. Simple Modifications Will Immediately Allow Local Data Traffic to be Carried More Efficiently on Current Circuit-switched Networks

As demonstrated above, there is little evidence that ESP/ISPs currently are causing significant congestion in the PSTN. Nonetheless, to the extent that there may be isolated congestion problems, they can be remedied through simple modifications to the existing circuit-switched network.

1. Originating end

There is no evidence that the growth of the Internet and other enhanced services has caused congestion in the ILEC end-offices that serve the ESP/ISP's customers (Point 4 in Figure 1²⁰).²¹ To the extent that there may be isolated instances of such congestion, they can be easily addressed using techniques such as load balancing and switch deloading, which are described in Section III.A.3, below.

¹⁹ *Id.* at 16, 17.

²⁰ See Attachment A.

²¹ *ETI Study* at 52. As even the Bell Operating Companies have recognized, the use of the Internet and other enhanced services is not likely to cause congestion at the originating end-office. See A. Atai and J. Gordon, "Impacts of Internet Traffic on LEC Networks and Switching Systems, at 3 (1996) ("Bellcore Working Paper"). ("[S]ince Internet traffic from a wide geographic area is typically funneled into the terminating switch, acute congestion is likely to occur first at the terminating switch."); Statement of Lee Bauman, Pacific Telesis, FCC Bandwidth Forum, Transcript at 130 (Feb. 23, 1997) (explaining that any "congestion issues are located at the [central] offices to which ESPs interconnect").

2. Center of the network

There also is little evidence that enhanced service traffic is causing congestion in the center of the public switched network (Points 5 and 6 in Figure 1).²² Indeed, ESP/ISPs may be using *fewer* network resources than other users.

The amount of congestion that an ESP/ISP can generate in the center of the network is limited by the number of access lines that the ESP/ISP obtains. Suppose that an ESP/ISP and a voice customer (such as a call center) both have the same number of incoming circuits. The maximum number of simultaneous calls that either entity can receive is equal to the number of incoming circuits it has obtained. If each entity has obtained the correct number of lines for its traffic load, the level of network resources that the two entities use will be the same.

If anything, an ESP/ISP with longer holding times may use *fewer* resources in the center of the network. As an example of this effect, suppose that an ESP's circuit is kept busy with three twenty-minute calls during an hour, while the circuit of the voice customer handles twenty three-minute calls. Each of the twenty shorter calls to the voice customer must be set up and torn down across the network. This consumes more switching-processor and signalling resources than is required to set-up and tear down the three longer calls to the ESP/ISP.

While most ESP/ISPs have obtained the appropriate number of circuits for the amount of traffic they receive, some ESP/ISPs currently may not do so.²³ Prior

²² See Attachment A.

²³ This situation is likely to disappear as ESPs/ISPs -- responding to competitive market forces -- deploy additional circuits.

to the development of common channel signalling, this would have imposed unnecessary costs on the center of the network. This is because in-band signalling established a link-by-link path from the originating to the terminating office (Point 4 through Point 7 in Figure 1)²⁴ that was used for a call that would never be completed. Today, common-channel signalling is widely deployed to inform the originating switch (Point 4) that the circuits at the terminating switch (Point 7) are busy without establishing a transmission path through the circuit-switched network. Thus, while an ESP/ISP's circuits are fully occupied, the ESP/ISP's customer will receive a busy signal from the originating switch and network resources between the originating and terminating ends of the call will not be used.

3. Terminating end

The only portion of the network in which ESP/ISPs conceivably could cause significant congestion is at the end-office that serves those entities. Circuits between the ILEC central office and the ESP/ISP can terminate on either the line-side or the trunk-side of the ILEC switch. Line-side terminations generally are more appropriate for circuits carrying lower levels of traffic -- such as circuits to individual residences, businesses, and smaller ESP/ISP locations. Trunk-side terminations, in contrast, are designed for circuits carrying more concentrated traffic -- such as circuits to customer-premises PBXs, voice call centers, and larger

²⁴ See Attachment A.

ESP/ISPs.²⁵ Regardless of which access arrangement an ESP/ISP uses, simple modifications to the existing network can remedy most of the isolated instances of congestion.

Load Balancing. In modern digital local switching systems, traffic from several hundred customer lines typically connects to a single line concentration unit ("LCU") within the central office. The LCU concentrates traffic from the individual customer lines into the central part of the switching machine, where the actual switching function is performed.²⁶ If an ESP/ISP with a heavy traffic load is connected to a line concentration unit, excessive blockage to other customers on the same LCU could occur. Any such problem, however, could easily be alleviated by distributing the ESP/ISP's lines among the concentration units, a procedure called *load balancing*.

Carriers have long used load balancing to accommodate voice traffic from customers with differing traffic patterns. This technique is very inexpensive; it merely requires the carrier to identify the high-usage lines, and to move these lines among peripheral units as required.

Deloading. A carrier also can respond to terminating-end congestion by reducing the number of high-use lines that terminate at a particular line concentration unit. This procedure is called *deloading*. Because much of the cost

²⁵ Many ESP/ISPs obtain trunk-side connections. For example, according to Bell Atlantic, 50% of ISPs in its region use primary rate ISDN, which is a trunk-side connection, to access the network. "Report of Bell Atlantic on Internet Traffic," at 5 (June 28, 1996).

²⁶ ETI Study at 9.

of a modern digital local switch is incurred on a per-line basis for plug-in line cards, and because a deloaded LCU requires fewer line cards, moderate deloading should not significantly increase per line costs.

Rational Pricing of Trunk-Side Connections. Virtually all terminating-end congestion problems that result from calls to ESP/ISPs could be resolved if most ESP/ISPs used trunk-side terminations. Indeed, such terminations typically cost less to provide per unit of traffic carried than line-side terminations, because, at high traffic volumes, line-side terminations may use the network less efficiently. Despite this fact, trunk-side terminations (and associated circuits to the customer's premises) often are priced at a higher rate than equivalent line-side arrangements.²⁷ Such pricing discourages appropriate network configurations for ESP/ISPs and others.²⁸ This problem can be addressed if the ILECs align their rates more closely with their underlying costs.

B. Even More Efficiencies Can be Achieved Quickly if Data Traffic is Migrated to Packet Networks

The ILECs' existing circuit-switched networks were developed for voice traffic. In *circuit* switching, a path is established between the calling and the called party for the entire duration of a call. This path uses switching and transmission resources whether or not any information is being transmitted over the path at any given moment.

²⁷ ILECs may adopt this pricing scheme for "strategic" purposes, such as encouraging customers to buy multiple business lines, rather than a single high-capacity line and a competitively provided multiplexer.

²⁸ ETI Study at 15-16.

In contrast, *packet-switched* networks, do not create permanent links between the sending and receiving parties. Rather, they make efficient use of shared network capacity by using network resources only when information actually is sent or received. This information is encapsulated into discrete units, called *packets*, each of which also contains the receiving party's address and other control information. The sending party launches a series of such packets into the network. Successive nodes in the network examine the packet's address information, and route the packets towards their destination. The packets are reassembled at the terminating node, prior to being delivered to the recipient. Packet network nodes usually are linked together by dedicated lines. Figure 2 illustrates the basic operation of a packet network.²⁹

Packet networks are uniquely suited for data traffic because such traffic often is bursty. For example, a user may make a few keystrokes or mouse clicks and launch a request for a page of information from the Internet's World Wide Web. The contents of the required Web page may then be returned, as a series of bursts in rapid succession. The user may spend time looking at the page before making another request for more information. Because packet networks do not create a dedicated physical path, idle time between transmissions does not generate additional network costs.³⁰

²⁹ See Attachment A.

³⁰ Some packet networks specify that the same pathway will be used from source to destination for successive packets during the duration of a packet session or "call." In such arrangements, some minimal network resources, such as entries in routing tables, are used for the entire duration of the session, but no physical transmission path is established.

In the future, an increasing number of customer access lines will carry both voice and data traffic. The most efficient means to accommodate the growth of data traffic is to remove this traffic from the circuit-switched network before (or at) the point it reaches the first circuit switch, and then route the traffic to on ESP/ISP over high-speed packet networks. Both Nortel and Lucent Technologies have created specialized products that make this possible.³¹

Any arrangement to remove data traffic from the public circuit-switched network requires a determination of which calls are data communications. This can be done by screening calls based on the number that is being called: if the called number has been assigned to an ESP/ISP, the call can be passed to a packet network. All other calls can be passed to the originating circuit switch and processed in the normal fashion. Nortel, in its Internet Thruway™ solution, performs this screening function through the use of a separate device placed in front of the originating switch.³² Figure 3A illustrates this arrangement.³³

Lucent Technologies has announced its Access Gateway™ product, which is integrated into the 5ESS switch.³⁴ This arrangement uses an Access Interface Unit, which is a new line unit for the 5ESS. If ESP/ISP customer lines are

³¹ Twitch, Steve, "A Wavelength in Every Garage," *Telephony*, vol. 231, no. 1, at 44 (July 1, 1996).

³² Snider, Beth, "Nortel Offers Crowded Public Networks Some Elbow Room," *Telephony*, vol. 231, no. 10, at 8 (September 2, 1996).

³³ See Attachment A.

³⁴ Emmett, Arielle, "The CO Gets a Makeover," *America's Network*, vol. 100, no. 17, at 60-62 (September 1, 1996).